Attorney Docket No. ISOT-022

APPLICATION

FOR UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, **Gregory S. Geschke**, a citizen of the United States, **William C. Gustafson**, a citizen of the United States, and **Alan B. Roberts**, a citizen of the United States, have invented a new and useful input/output transition board system of which the following is a specification:

Input/Output Transition Board System

CROSS REFERENCE TO RELATED APPLICATIONS

Not applicable to this application.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

This invention was made with Government support under Contract No. N68335-00-D-0451 awarded by Naval Air Systems Command. The Government has certain rights in this invention.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to input/output (I/O) boards and more specifically it relates to an input/output transition board system for collecting and distributing input/output signals between a backplane and an I/O board while allowing for additional electronic devices.

Description of the Related Art

Conventional backplanes have been in use for years upon various electronic units. Backplanes typically include a plurality of sockets that receive a corresponding number of cards. Some backplanes include a plurality of rear panel connectors that are in direct communication with the sockets. Exemplary backplane technologies include VME (VersaModule Eurocard), PCI (Peripheral Component Interconnect), cPCI (compact PCI) and related backplane technologies.

In thermal management applications (e.g. spray cooling, air cooling), an enclosure surrounds the electronic devices being thermally managed. I/O connectors are required to allow for the connection of external electronic devices. The I/O connectors are typically directly wired to the backplane with numerous wires (not shown). There are typically hundreds and sometimes thousands of wires required for all of the I/O connectors (each I/O connector typically has between 10 – 150 contacts). This wire configuration is time consuming to make and install. In addition, the wire configuration does not provide reliable impedance and is prone to failure (e.g. solder breakage, wire abrasion). Also, the wire configuration requires a significant amount of space within the enclosure.

To solve the inherent problems with wire configurations, ISOTHERMAL SYSTEMS RESEARCH, INC. developed an I/O board that is in direct communication between the I/O connectors and a backplane as shown in Figure 1 of the drawings. This configuration eliminates the usage of numerous wire connections between the I/O connectors and the backplane. However, there is a need for additional electronic devices and functionality to be included within the enclosure without significantly increasing the size of the enclosure (e.g. transceivers, Ethernet physical layer, current limiters, power sources, individual resets for selected backplane slots).

While these devices may be suitable for the particular purpose to which they address, they are not as suitable for collecting and distributing input/output signals between a backplane and an I/O board while allowing for additional electronic devices. Conventional electronic communication systems for I/O connectors and a backplane do not allow for additional electronic devices and functionality.

In these respects, the input/output transition board system according to the present invention substantially departs from the conventional concepts and designs of the prior art, and in so doing provides an apparatus primarily developed for the purpose of collecting and distributing input/output signals between a backplane and an I/O board while allowing for additional electronic devices.

BRIEF SUMMARY OF THE INVENTION

In view of the foregoing disadvantages inherent in the known types of backplane and I/O board connections now present in the prior art, the present invention provides a new input/output transition board system construction wherein the same can be utilized for collecting and distributing input/output signals between a backplane and an I/O board while allowing for additional electronic devices.

The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new input/output transition board system that has many of the advantages of the backplane and I/O board connections mentioned heretofore and many novel features that result in a new input/output transition board system which is not anticipated, rendered obvious, suggested, or even implied by any of the prior art backplane and I/O board connections, either alone or in any combination thereof.

To attain this, the present invention generally comprises a transition board having at least one front connector and at least one rear connector. The front connector is connectable to a corresponding rear panel connector within a backplane. The rear connector is connectable to a corresponding front I/O connector of an I/O board. The transition board collects and passes the signals between the I/O board and the backplane. The transition board is also preferably active with additional electronic devices connected to the transition board.

There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional features of the invention that will be described hereinafter and that will form

the subject matter of the claims appended hereto.

In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

A primary object of the present invention is to provide an input/output transition board system that will overcome the shortcomings of the prior art devices.

A second object is to provide an input/output transition board system for collecting and distributing input/output signals between a backplane and an I/O board while allowing for additional electronic devices.

Another object is to provide an input/output transition board system that allows for attachment of accessory devices such as but not limited to transceivers, voltage and current regulators, filters, receivers, transmitters, port monitors and the like.

An additional object is to provide an input/output transition board system that significantly reduces the usage of discrete wiring.

A further object is to provide an input/output transition board system that provides reliable impedance and communications.

Another object is to provide an input/output transition board system that is resistant to communication disruption.

A further object is to provide an input/output transition board system that is efficient and economical to manufacture and assemble.

Another object is to provide an input/output transition board system that minimizes the required size of an enclosure.

A further object is to provide an input/output transition board system that allows for the usage of commercial off the shelf cards and backplane boards.

Other objects and advantages of the present invention will become obvious to the reader and it is intended that these objects and advantages are within the scope of the present invention.

To the accomplishment of the above and related objects, this invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific construction illustrated and described within the scope of the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

FIG. 1 is a top view illustrating an exemplary prior art backplane connected to an I/O board.

FIG. 2 is an upper perspective view of the present invention.

FIG. 3 is an exploded upper perspective view of the present invention.

FIG. 4 is a top view of the present invention.

FIG. 5 is an exploded top view of the present invention.

FIG. 6 is an upper perspective view of an alternative embodiment of the present invention.

FIG. 7 is an exploded upper perspective view of the alternative embodiment.

FIG. 8 is a top view of the alternative embodiment.

FIG. 9 is an exploded top view of the alternative embodiment.

FIG. 10 is a top view of a second alternative embodiment of the present invention disclosing a plurality of auxiliary boards.

DETAILED DESCRIPTION OF THE INVENTION

A. Overview

Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, FIGS. 2 through 10 illustrate an input/output transition board system **10**, which comprises a transition board **70** having at least one front connector **72** and at least one rear connector **73**. The front connector **72** is connectable to a corresponding rear panel connector within a backplane. The rear connector **73** is connectable to a corresponding front I/O connector **22** of an I/O board **20**. The transition board **70** collects and passes the signals between the I/O board **20** and the backplane. The transition board **70** is also preferably active with additional electronic devices **74** connected to the transition board **70**. The I/O board **20**, the transition board **70** and the backplane board **60** are preferably substantially parallel to one another in order to reduce the size necessary for the enclosure **14**.

B. Enclosure

An enclosure **14** preferably surrounds the I/O board **20**, the transition board **70** and the backplane board **60** along with the cards **12** connected to the backplane board **60**. The I/O connectors are extendable through a wall of the enclosure **14** as best illustrated in Figures 4 and 5 of the drawings. In addition, the I/O board **20** preferably attached to an inner surface of the enclosure **14** as further shown in Figures 4 and 5 of the drawings.

A card cage may be utilized within the enclosure **14** to support the cards **12** as is well known in the art. U.S. Patent No. 5,880,931 illustrates an exemplary card cage for enclosures **14** and is incorporated by reference.

The enclosure **14** may be comprised of various structures commonly utilized to retain electronics. The enclosure **14** may be comprised of air-cooled, liquid cooled or spray cooled structures which are well known in the art. The enclosure **14** may be comprised of a sealed or non-sealed structure.

C. I/O Board

The I/O board **20** may be comprised of any conventional I/O board **20** capable of transferring communications which are well known in the art. The I/O board **20** is preferably attachable to an interior surface of an enclosure **14** as shown in Figures 4 and 5 of the drawings. The I/O board **20** may be distally spaced from the inner surface of the enclosure **14**, however this distance is preferably less than 1.0 inch.

The I/O board **20** has one or more rear I/O connectors **50** that provide an electrical communications pathway into the interior of the enclosure **14** as illustrated in Figures 3, 4 and 5 of the drawings. The rear I/O connectors **50** are preferably hermetic and extend through a wall of the enclosure **14** in a sealed manner as further shown in Figures 4 and 5 of the drawings. Each of the rear I/O connectors **50** preferably includes at least about 10 - 150 electrical conductors; however the rear I/O connectors **50** may have less than 10 - 150 electrical conductors.

As shown in Figures 2 through 10 of the drawings, one or more front I/O connectors **22** are connected to the I/O board **20** for transferring communications from the I/O board **20** to the transition board **70**. The front I/O connectors **22** may be positioned in various locations upon the side of the I/O board **20** opposite of the I/O connectors. It is preferable to first determine the positions of the rear I/O connectors **50** upon the I/O board **20** before determining the locations of the front I/O connectors **22**. It is also possible to have the front I/O connectors **22** positioned on opposite ends of the I/O board **20** to provide a central space with respect to the transition board **70** to allow space for accessory devices **74** as shown in Figures 3 through 5 of the drawings.

In addition, a space between the I/O board **20** and the transition board **70** also provides room for solder connections with the rear I/O connectors **50**. The solder connections may be comprised of a socket type structure that receive pins from the I/O connectors **50**.

The front I/O connectors **22** and the rear I/O connectors **50** are preferably comprised of a high density connector structure having a plurality of electrical conductors (e.g. male, female). The front I/O connectors **22** and the rear I/O connectors **50** are electrically connected to circuits within the I/O board **20** for transferring the data between the rear I/O connectors **50** and the front I/O connectors **22**.

D. Transition Board

The transition board **70** provides additional space for the addition of accessory devices **74** between the I/O board **20** and the backplane board **60**. The transition board **70** may be comprised of any conventional circuit board structure. The transition board **70** is also preferably active since the purpose of the transition board **70** is to not only transfer data between the backplane board **60** and the I/O board **20**, but to also manipulate, monitor or modify this data midstream.

The transition board **70** includes one or more rear connectors **73** connected to the front I/O connectors **22** as shown in Figures 4 and 5 of the drawings. The rear connectors **73** are comprised of a connector structure similar to the front I/O connectors **22** and are positioned upon the transition board **70** in order to align with the I/O connectors. As can be appreciated, the connectors **22**, **32**, **62**, **72**, **73** may be comprised of any connector structure capable of transferring electrical communications.

The transition board **70** further includes one or more front connectors **72** connected to the rear backplane connectors **62** of the backplane board **60** as shown in Figures 4 and 5 of the drawings. The front connectors **72** are comprised of a connector structure similar to the rear backplane connectors **62** and are positioned upon the transition board **70** in order to align with the rear backplane connectors **62**.

The rear connectors **73** and the front connectors **72** of the transition board **70** may be positioned in a spaced apart relationship to provide space for the accessory devices **74** positioned between thereof as shown in Figures 7, 8, 9 and 10 of the drawings. However, the front connectors **72** may be positioned near one another particularly if the backplane board **60** has a plurality of rear panel connectors as shown in Figures 3, 4 and 5 of the drawings.

The transition board **70** is preferably distally spaced a distance from the backplane board **60** and a distance from the I/O board **20** as shown in Figures 4, 8 and 10 of the drawings. The distance is preferably between about 0.4 to 1.0 inch which provides sufficient space between the boards **20**, **60**, **70** to receive the one or more accessory devices **74** connected to the transition board **70**.

The accessory devices **74** may be comprised of various electronic devices **74** such as but not limited to transceivers, receivers, transmitters, voltage regulators, current regulators, power sources, filters, port monitors, microprocessors, memory, crossbar switch for I/O assignment, and individual resets for selected backplane slots. The accessory devices **74** are electrically connected to circuits within the transition board **70**. The accessory devices **74** may also manipulate data received from either the I/O board **20** or the backplane board **60**.

E. Backplane Board

The backplane board **60** may be comprised of any conventional backplane board **60** configuration such as but not limited to VME (VersaModule Eurocard), PCI (Peripheral Component Interconnect), cPCI (compact PCI). The backplane board **60** has one or more rear backplane connectors **62** connected to the front connectors **72** of the transition board **70** as shown in Figures 4 and 5 of the drawings.

In addition, the backplane board **60** preferably has one or more sockets **64** for receiving one or more cards **12**. The sockets **64** are on a side opposite of the rear backplane connectors **62** as shown in Figures 4 and 5 of the drawings. The sockets **64** are preferably in communication with the rear backplane connectors **62**, where the rear backplane connectors **62** are comprised of a rear panel connector structure to allow for pass through communications between the sockets **64** and the rear backplane connectors **62**.

F. Auxiliary Board

As shown in Figure 10, at least one first auxiliary connector **32** is connected to the backplane board **60** for receiving a first auxiliary board **30**. In addition, at least one second auxiliary connector **32** may be connected to the first auxiliary board **30** and a second auxiliary board **30** is connected to the second auxiliary connector **32**. The auxiliary boards **30** may be comprised of any circuit board architecture and may include one or more electronic devices **74**. The auxiliary boards **30** may also include I/O connectors that extend through the enclosure **14** as shown in Figure 10 of the drawings. The auxiliary boards **30** may extend about the interior perimeter of the enclosure **14** as further shown in Figure 10 of the drawings.

What has been described and illustrated herein is a preferred embodiment of the invention along with some of its variations. The terms, descriptions and figures used herein are set forth by way of illustration only and are not meant as limitations. Those

skilled in the art will recognize that many variations are possible within the spirit and scope of the invention, which is intended to be defined by the following claims (and their equivalents) in which all terms are meant in their broadest reasonable sense unless otherwise indicated. Any headings utilized within the description are for convenience only and have no legal or limiting effect.